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ABSTRACT

Ways in which to determine whether the aptitude, intelligence, or achievement test is more helpful are discussed. A test's function, i.e., how the test results are used, appears to be the most logical method of discriminating between the types of tests. In educational testing, if the purpose is to evaluate the effectiveness of teaching or training, and the test is designed to measure what has been specifically taught, it is an achievement test. The same holds true if the intent is to grade students on the basis of what they have learned in a course. If the interest is only in predicting grades, a numerical aptitude test is perhaps best. If it is desired to predict success in several subjects at the same time, achievement tests can be used. This approach is most effective where past and future courses are most alike. Achievement tests can function as aptitude measures best in the early school years, less well at the junior and senior high school levels where courses became increasingly differentiated. Another possible choice for predicting success in various courses is the scholastic aptitude or so-called group intelligence test. To the extent that various courses demand verbal and/or numerical facility for successful learning, a test that measures those aptitudes will probably prove useful. A third alternative is the use of differential aptitude test batteries, which provide broader coverage of mental functioning than the scholastic aptitude test. In the business world, multi-score employment tests are often more useful than single-score tests in employee selection. (For related document, see TM 002 944.) (DB)

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# Test Service Bulletin

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HAROLD G. SEASHORE, *Editor*
*Director of the Test Division*

ALEXANDER G. WESMAN
*Associate Director of the Test Division*

JEROME E. DOPPELT
JAMES H. RICKS, JR
WIMBURN L. WALLACE
*Assistant Directors*

## APTITUDE, INTELLIGENCE, AND ACHIEVEMENT

WHICH is more helpful—an aptitude test or an achievement test?—a general mental ability test or a differential aptitude test battery? There are purposes for which each kind of test is superior; there are circumstances in which all are useful; there are conditions when any one of these types may be pressed into service to yield information ordinarily obtained from another type of test. What are these purposes, circumstances and conditions? When should an achievement test be used rather than an intelligence test, or an aptitude test? What advantages do multiple-score aptitude batteries have over single-score intelligence tests?

As a preliminary, let us look at the basic characteristics of achievement tests, intelligence tests and aptitude tests. By definition, an achievement test measures what the examinee has learned. But an intelligence test measures what the examinee has learned. And an aptitude test measures what the examinee has learned. So far, no difference is revealed. Yet three of the traditional categories into which tests are classified are intelligence, aptitude and achievement. Now these categories are very handy; they permit publishers to divide their catalogs into logical segments, and provide textbook authors with convenient chapter headings. Unfortunately, the categories represent so much oversimplification as to cause confusion as to what is being measured. What all three kinds of tests measure is what the subject has learned. The ability to answer a proverbs item is no more a part of the examinee's heredity than is the ability to respond to an item in a mechanical comprehension test or in a social studies test. All are learned behavior.

Moreover, all are intelligent behavior. It takes intelligence to supply the missing number in a number series problem. It also requires intelligence to figure out which pulley will be most efficient, or to remember which president proposed an inter-American doctrine. We can say, then, that an intelligence test measures intelligent behavior, an aptitude test measures intelligent behavior and an achievement test measures intelligent behavior.

Finally, all three types of tests measure probability of future learning or performance, which is what we generally mean when we speak of "aptitude." In business and industry, the chances that an employee will profit from training or will perform new duties capably may be predicted by scores on an intelligence test, by scores on one or more specific aptitude tests, or by some measure of the degree of skill the employee already possesses. Similarly, test users in the schools know that an intelligence test is usually a good instrument for predicting English grades, a social studies test is often helpful for prediction of future grades in social studies, and a mechanical comprehension test is likely to be useful in predicting for scientific or technical courses. So, intelligence tests are aptitude tests, achievement tests are aptitude tests and aptitude tests are aptitude tests.

### Content—what the test covers

On what basis are the types to be differentiated? One possible basis is that of content. Quite often, we can look at the subject matter of a test and classify the test as achievement or intelligence or aptitude. But content is not a sure guide by any means.

Let us take a specific item. A student is taught to multiply (x−y) by (x). If he demonstrates that he can perform this operation correctly, we accept this item as

an achievement measure. Next, without specific formal instruction, he is asked to multiply (p+q) by (p–q), and again answers correctly. Is this achievement? The mathematics teacher would say it is. Is it aptitude? Certainly the ability to perceive the analogy between the taught and untaught algebraic problems is indicative of future learning ability in algebra. Is it intelligence? The demonstrated ability to generalize is clearly symptomatic of intelligence.

The same point can be made with regard to entire subtests. In the *Metropolitan Achievement* series there is a Spelling test; one of the *Differential Aptitude Tests* is also a test called Spelling. Tests of arithmetic comprehension may be found in most achievement batteries; one of the subtests in each of the *Wechsler Intelligence Scales* measures arithmetic comprehension. What does all this mean? Have we demonstrated that the authors of these tests are confused, or is our classification system less neat and simple than it appears to be on the surface?

We believe the classification system is at fault. The teacher who has taught pupils how to solve arithmetic problems is perfectly justified in claiming that the pupils' performance on tests in these abilities represents achievement–both hers and theirs. At the same time, the learning of the skills and appreciations by the pupils is evidence of intelligence. Furthermore, the possession of the skills and of the ability to learn demonstrates the possession of aptitude for further learning in those same school subjects, and probably in other subjects as well. For example, scores on the *DAT* Spelling Test provide excellent prediction of success in learning stenography.

**Process—what the examinee has to do**

It would appear, then, that test content is not entirely adequate to discriminate among intelligence, achievement and aptitude testing. Can we use process to discriminate among them? Shall we say that achievement is measured when the subject is tested for recall of what he has been taught, and that intelligence is shown in the ability to generalize from the facts?

Every modern educator and every modern test constructor would reject such classification outright. Rare is the teacher who will admit her students are merely memorizing facts; rare is the curriculum which is not aimed at developing the ability to generalize, to apply learned principles in new situations. Furthermore, inspection of the items in some of our most highly regarded intelligence tests will reveal many items which are as direct questions of fact as any to be found in the least imaginative achievement tests. Processes of recognition, recall and rote repetition may be distinguishable from processes of generalization, appreciation, and problem solving–but apparently they are not satisfactory for distinguishing between intelligence and achievement.

**Function—how the test results are used**

If test content will not serve, nor test process, what will successfully discriminate intelligence or aptitude from achievement measures? A logical candidate would seem to be function. What are we trying to accomplish with the test scores? How are the results to be used? What inferences are to be drawn concerning the examinee? If a test's function is to record present or past accomplishment, what is measured may be called achievement. If we wish to make inferences concerning future learning, what is measured is thought of as aptitude. One kind of aptitude test, usually some combination of verbal and numerical and/or abstract reasoning measures, is sometimes called an intelligence test; more properly, in educational settings, it is called a scholastic aptitude test.

**In educational testing . . .**

If the purpose is to evaluate the effectiveness of teaching or training, and the test is designed to measure what has been specifically taught, we have an achievement situation. The more closely the test reflects what has been taught, the better it suits the purpose. The statement holds equally well if the intent is to grade students on the basis of what they have learned in a course. If, in addition, we wish to infer how well a student will learn in the future, we have an aptitude situation. The greater the similarity between what has been learned and what is to be learned, the better the achievement test suits the aptitude purpose. A test of achievement in first term algebra is likely to be an excellent test of aptitude for second term algebra. On the other hand, such a test is likely to predict less well future course grades in physics, French and shop. Nor can an achievement test in algebra be used effectively to predict course grades before the students have been exposed to algebra. Some other measure of aptitude is required.

If we are interested only in predicting algebra grades, a numerical aptitude test is likely to prove best. The chances are, however, that we are also interested in predicting success in other subjects at the same time. In that case, we have several choices. We can select achievement tests in as many relevant or nearly relevant subjects as are available, and use these tests as predictors. This approach will obviously be most effective where past and future courses are most alike; it will be least effective where past and future courses are least alike. Concretely, achievement tests can function as aptitude measures best in the early school years, less well at the junior and

senior high school levels where courses become increasingly differentiated.

Another possible choice for predicting success in various courses is the scholastic aptitude or so-called group intelligence test. To the extent that various courses demand verbal and/or numerical facility for successful learning, a test which measures those aptitudes will probably prove useful. Again, this verbal-numerical ability is likely to play a more pervasive role in the elementary grade subjects than in the high school. Even at the high school level, grades are so often affected by the student's verbal expression that scholastic aptitude tests often correlate well with those grades even in subjects such as mechanical drawing and music. In such courses when grades are assigned on the basis of what the student can *do*, rather than how well he can speak or write about it, the predictive value of verbal or verbal-numerical aptitude tests is likely to be less.

A third alternative is the use of differential aptitude test batteries. These batteries ordinarily include measures of verbal and numerical aptitude, just as the scholastic aptitude intelligence tests do; they also provide measures of other aptitudes as well—spatial, mechanical, clerical, and the like. The instruments yield a set of scores which recognize intra-individual differences, accepting the fact that a student may be fairly high in verbal ability, average in numerical, very high in mechanical aptitude, and very poor in clerical speed and accuracy. These multi-score batteries provide broader coverage of mental functioning than is obtainable from the more limited scholastic aptitude test.

Is this broader coverage worth the effort? It depends on what the user wants to accomplish. If only the probability of success in an English class is of interest, a scholastic aptitude test might well suffice—information concerning other abilities may not improve prediction enough to be worth obtaining. If several varied criteria are of interest, as in guidance into an academic, trade or commercial curriculum, the additional information provided by differential aptitude batteries should be well worth the effort. Interest in broad and varied criteria is greatest at the secondary school level, where the pupil reaches points of decision. At this time, the pupil and the school should be considering what kind of curriculum is best for him, what are appropriate directions and levels of aspiration for the immediate and the more distant future. Educational and vocational guidance are of tremendous importance; therefore, the broadest scope of ability testing is both desirable and eminently worthwhile. True, differential aptitude testing takes more time and costs more money. A two-, three-, or four-hour difference in time, or a dollar per pupil difference in cost, should be seen in the perspective of all the years of each student's educational and occupational future. The choices to be made may well set the pattern of the student's life; information to help guide those choices warrants the additional expenditure of minutes and pennies.

**And in the business world**

The use of the educational frame of reference should not be taken to mean that the points do not apply to industry. They do. Readers engaged in personnel work in business and industry will have seen parallels between the last few paragraphs and their own problems, but will be conscious of some differences, too. For example, multi-score employment tests are often more useful than single-score tests in employee selection simply because they give a clearer picture of several aspects of ability that are mixed in unknown proportions in the single score. On the other hand, it is more often necessary for the industrial man than for the educator to make do with a less appropriate test. Many of the specific aptitude or achievement tests industry needs simply do not exist as yet, or do not work very well. In such cases, a general mental ability test or a semi-relevant aptitude test may be better than nothing even though we realize that a proficiency test would give us still more useful information about the applicant.

**In summary**

Which kinds of tests are most helpful? Any test is helpful or harmful only as it is used properly or misused. The information which can be obtained from group tests of general intelligence, so-called, is often valuable. The information can be misinterpreted, and perhaps the use of the word "intelligence" predisposes somewhat to misinterpretation; but *any* test score can be misinterpreted. The issue is really whether scholastic aptitude or general mental ability tests provide *enough* information, and here one can only say "enough for what?" For some important decisions, and at some educational levels, the information is probably adequate. For other decisions, and at other levels, the additional information provided by differential ability tests is needed.

Whether achievement, intelligence or differential aptitude tests should be used depends on the functions to be served. The test user should ask "what inferences do I want to make; what information do I need to make those inferences?" The user who answers those questions will show intelligence, achievement of proficiency in test usage, and special aptitude for further advances in psychometrics.—A.G.W.